AIRCRAFT CIRCULARS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

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THE AVRO "ANSON" GENERAL-PURPOSE AIRPLANE (BRITISH)

A Two-Engine Low-Wing Cantilever Monoplane

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THE AVRO "ANSON" GENERAL-PURPOSE AIRPLANE (BRITISH)*

A Two-Engine Low-Wing Cantilever Monoplane

The "Anson", although designated in its service guise a general observation aircraft, is essentially a highly efficient general-purpose type, and the uses to which it could be put by an air force are manifold. Obviously, with its twin engines, good load-carrying ability and long range, it is admirably suited to foreign service, and could fulfill its many and varied duties with economy, and, by virtue of its simple, robust, and well-tried structure, within the minimum of upkeep.

The "Anson" is essentially a development of the Avro 652 commercial monoplane. Testimony is borne to the structural similarity of the two airplanes by the fact that the "Anson" bears the Avro works number 652A. In external appearance, however, there are numerous features of dissimilarity (figs. 1, 2, and 3).

It may be advantageous to recall that the one-piece cantilever wing embodies two main box spars with flanges of laminated spruce and plywood webs, joined by closely spaced ribs of spruce and plywood (fig. 4). The fuselage is a framework of welded steel tubes with fairings of wood and fabric covering, excepting the nose portion, which is paneled with elektron.

The "Anson" is the first airplane with a retractable landing gear to be adopted for the R.A.F. Each of the two separate portions of the landing gear is mounted under each engine nacelle, and is normally retracted by mechanical means; there is a crank handle for alternative operation (fig. 5). Dunlop wheels, tires, and pneumatic brakes and Turner legs are fitted as standard. When the wheels are in the "up" position, a small portion of each tire protrudes below the nacelles. The swiveling tail wheel is not retractable.

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*From Flight, January 30, and The Aeroplane, January 29, 1936.

Mass balances are used on the rudder and elevator, and the ailerons are of the Frise variety. The stabilizer is fixed, but the elevator, like the rudder, has a small trimming tab actuated by a handwheel in the cockpit.

Siddeley Cheetah IX 7-cylinder radials are fitted to the "Ansons" under construction for the R.A.F. The Cheetah IX is rated at 310 horsepower at 6,000 feet, and is designed for operation on the new service fuel of 87 octane number. Each of the "Anson's" Cheetahs is provided with its own fuel and oil tanks, these being of welded aluminum and mounted in cradles in the wing. Duplicated fuel pumps mounted on the engines themselves feed the fuel to the carburetors. The engine mountings are welded tubular steel frames.

An interesting form of cowling is being used. It is fairly long in chord and small in diameter, the actual cylinder heads and valve gear being housed in scallops or helmets standing out from the main body of the cowling. This arrangement permits a nacelle of comparatively small diameter to be used, and improves, in consequence, the lateral vision, which is of great importance in an observation airplane. The propellers are two-blade metal Faireys.

At the moment the "Anson" is not fitted with flaps, but an experimental Dowty-operated set is being prepared, and due weight allowance has been made in the production "Ansons" for their fitting. Apart from increasing the gliding angle they should reduce the landing speed of 66 miles per hour by 9 miles per hour, thus facilitating small-airport operation.

For general observation duties, a crew of three is carried, consisting of a pilot (who operates the fixed gun), the navigator (who performs the duties of bomb aimer), and a wireless operator, who is alternatively the rear gunner (fig. 2).

In the extreme nose of the fuselage is the prone bombing position, with the bomb sight and appropriate instruments, a drift sight, and a Harley landing light. The pilot's cockpit is immediately aft of this and is provided in the production model, with Cellastoid panels in the roof in place of the original metal covering. Parallel motion-rudder pedals are fitted on the port side, where the pilot sits, and the ailerons and elevator are operated

through a normal stick and wheel control. The main instrument panel bears all the usual dials; the instruments for blind flying being attached to a shockproof mounting. Indirect instrument lighting is provided for night flying.

PILOT'S EQUIPMENT

The pilot has a single Vickers 0.303-inch machine gun, the breech of which is easily accessible to his left hand; the barrel protrudes into a channel in the nose fairing. Four hundred rounds of ammunition can be accommodated in the belt box, and the sights are of the ring and bead type, the ring being mounted in an inverted position actually inside the cockpit. A set of bomb release controls is also provided for the pilot's use. Other items suitably placed near the pilot are warning signals showing the position of the retractable landing gear, fuel controls, and handles for the operation of the trimming tabs. Just behind the pilot's seat are racks for two parachute packs, which are clipped in an emergency to the harness of the pilot and navigator. There is a small folding seat nearby, on the starboard side. Dual control may be fitted for training, but it is not then possible to use the prone bomber's position.

The cabin proper starts behind the pilot's seat and extends rearward as far as the gun turret. Windows of Triplex and Cellastoid now extend for its entire length on both sides, those in the center being arranged to hinge inboard. Entering the cabin from the forward end, one finds the navigator's position, between the spars, on the port side. The navigator has a chair and table, bearing compasses, Bigsworth chart boards, sea markers, course and wind calculators, course and speed calculators, signaling lamp and float flares, all stowed in convenient positions in the cabin (figs. 6 and 7). Aft of the rear spar is that portion of the cabin occupied by the wireless operator when he is not working the rear gun. Here, on the starboard side, is a table bearing standard service W/T apparatus, the trailing aerial winch, parachute pack, fire extinguisher, etc. (figs. 8 and 9). The fixed aerial sprouts from the fuselage roof behind the cockpit.

A door in the bulkhead at the rear of the cabin gives entry to the Armstrong-Whitworth gun turret (figs. 10 and 11).

This turret* was designed to provide a mounting for a free gun on high-speed airplanes, and ia applicable to nose, amidships, and aft gun positions. Briefly, its purpose is to protect the gunner and to enable the gun to be trained with a minimum of physical effort. A seat is provided for the gunner, who has his weight balanced against that of the gun. There is a special link motion whereby the gunner's line of vision remains in the same relation to the gun sights throughout the entire range of elevation. It is claimed that the balancing of the mechanism completely overcomes the effect of accelerations during maneuvers. To fire vertically downward the gunner stands, and the weight of his gun is taken directly on the mounting.

Operation is entirely manual. The turret rotates on rollers on a vertical track, rotation being effected by reaction from the gunner's feet on the rubber-covered cockpit floor. A mechanical lock is fitted to enable the turret to be locked at any desired angle or traverse. Merely leaning backward or forward is sufficient to alter the elevation, and in practice, it is said, this movement is quite natural, demanding no mental effort by the gunner. A small movement on the seat compensates for the varying weight of gunners.

Although independent locks are provided for both the rotational and elevating movements, it has been found in practice that the gun can be fired with the entire mechanism free, no ill effects being experienced from recoil. It is possible, therefore, to follow a target continuously.

The only external unbalanced force is that caused by the protrusion of the gun barrel. Firing aft, and through a horizontal traverse of 60 degrees on each side, it is claimed, no inconvenience is experienced at any speed. When firing fully broadside, however, the gun barrel creates a rotational force which must be resisted by the gunner.

Substantially of spherical formation, the turret casing consists of a metal framework and suitably formed Rhodoid panels. The slot through which the barrel of the gun protrudes is fitted with an articulated sliding cover allowing the turret to be completely sealed when the gun is not in use. Complete, the turret weighs roughly 97 pounds.

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*This page describing the turret, taken from Flight, January 23, 1936.

In this turret is a Lewis gun and five 97-round ammunition drums. A first-aid box, accessible from the exterior of the airplane, is also included.

The main door to the cabin is located on the starboard side just forward of the turret. Two emergency exits are provided in the roof.

Normally the bomb load, which is stowed in the wings, consists of two 100-pound bombs and four or eight 20-pound bombs, which are dropped through trap doors. All bombs are released electrically but are fused by mechanical means. If eight 20-pound bombs are carried instead of four, the fuel load is reduced to 128 gallons and the duration of the aircraft to 4.25 hours.

Stowed in the tail fairing of the starboard nacelle is an inflatable dingey which is provided with automatic actuators to the rear of the engine and in the nose of the fuselage. The Walter Kidde system of inflation is used; this makes use of a bottle of liquid carbon dioxide. An emergency release cord is also fitted on the outside of the fuselage. A marine distress signal is provided under a tear-off patch at the bottom of the fin, and two further signals are secured to the hand line on the dingey.

The internal lay-out of the "Anson" is clearly shown in figure 2

SPECIFICATION*

Wings:

One-piece low cantilever wing.

Two main box spars with laminated spruce flanges and plywood webs.

Closely placed ribs of spruce and plywood.

Whole covered with plywood.

Frise ailerons of wood covered with plywood.

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*From The Aeroplane, January 29, 1936.

Fuselage:

Welded tubular steel frame, rigidly braced.

Aft portion cross-braced with wire.

Linen covering over wood fairings except at nose,, which is of elektron.

Tail unit:

Cantilever fin, integral with fuselage, covered with fabric.

Fixed cantilever wooden stabilizer covered with plywood.

Wooden plywood-covered elevators, on common spar, are divided by fixed end of fuselage beneath rudder, trimming tabs in each.

Plywood-covered rudder with trimming tab in tail.

Landing gear:

Retractable.

Medium pressure Dunlop wheels carried between Turner pneumatic shock absorbers.

Whole lifts into engine nacelle by mechanical means or by manual operation.

Dunlop pneumatic brakes.

Sprung self-centering tail wheel.

Power plant:

Two Siddeley Cheetah IX engines, each developing 310 horsepower at 2,100 r.p.m., at 6,000 feet.

Two 35-gallon fuel tanks, outboard of each engine, in each wing.

One 7-gallon oil tank behind each engine.

Duplicate fuel pumps on each engine.

Accommodation:

Crew of three.

Prone bombing position in nose for navigator-bomber.

Pilot's seat on port side.

Provision made on starboard side for dual control for training.

Navigator's seat in cabin behind pilot.

Seat behind him for gunner-radio-operator

Parallel motion rudder pedals and wheel control.

Blind-flying instruments on shockproof panel.

Armament:

One fixed Vickers gun firing forward on port side.

Carriers for four 20-pound bombs beneath fuselage and two 100-pound bombs in wing roots.

One Vickers gun in rotatable Armstrong-Whitworth turret behind cabin.

Dimensions:

Span, 56 feet 6 inches (17.22 meters).

Height (tail down), 13 feet 1 inch (3.99 meters).

Length, 42 feet 3 inches (12.88 meters).

Wheel track, 13 feet 8 inches (4.17 meters).

Engine centers, 13 feet 8 inches (4.17 meters).

Mean chord, 8 feet 4 inches (2.54 meters).

Weights:

Weight empty (with trailing-edge flaps), 4,870 lb. (2,210 kg).

Pilot's flying and engine instruments, 40 lb. (18.15 kg).

Military load,* 850 lb. (386 kg).

Rotating turret, 86 lb. (39 kg).

Crew (3) and parachutes, 600 lb. (272 kg).

Fuel (140 gal.), 1,078 lb. (490 kg).

Oil (14 gal.), 126 lb. (57 kg).

Weight loaded, 7,650 lb. (3,470 kg).

Performance:- Maximum speeds:

At sea level, 174 m.p.h. (280 k.p.h.).

" 7,000 ft. (2,135 m), 188 m.p.h. (303 k.p.h.)

" 10,000 " (3,048 m), 184 " (296 ")

" 15,000 " (4,575 m), 177 " (285 ")

" 20,000 " (6,096 "), 163 " (262 ")

Landing speed (with trailing-edge flaps), 57 m.p.h. (92 k.p.h.).

Cruising speed, at 6,000 ft. (1,830 m), 160 m.p.h. (258 k.p.h.).

Rates of climb -

At sea level, 1,000 ft./min. (5.09 m/s).

" 6,000 ft. (1,830 m), 950 ft./min. (4.83 m/s).

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*One Lewis gun and four drums of ammunition; one Vickers gun and 400 rounds; four 20-pound bombs and carriers; two 100-pound bombs and carriers; bombers instruments, pyrotechnics, general electrical services, navigational instruments, radio, etc.

Performance (cont.):

Time of climb -

To 1,000 ft. (305 m), 1.3 min.

" 5,000 " (1,524 m), 6.1 min.

" 10,000 " (3,048 m), 12.1 "

" 15,000 " (4,575 m), 21.2 "

" 20,000 " (6,096 m), 39.9 "

Service ceiling, 21,400 ft. (6,520 m).

Absolute ceiling, 24,000 ft. (7,320 m).

Duration at cruising speed, 4.7 to 5 hours.

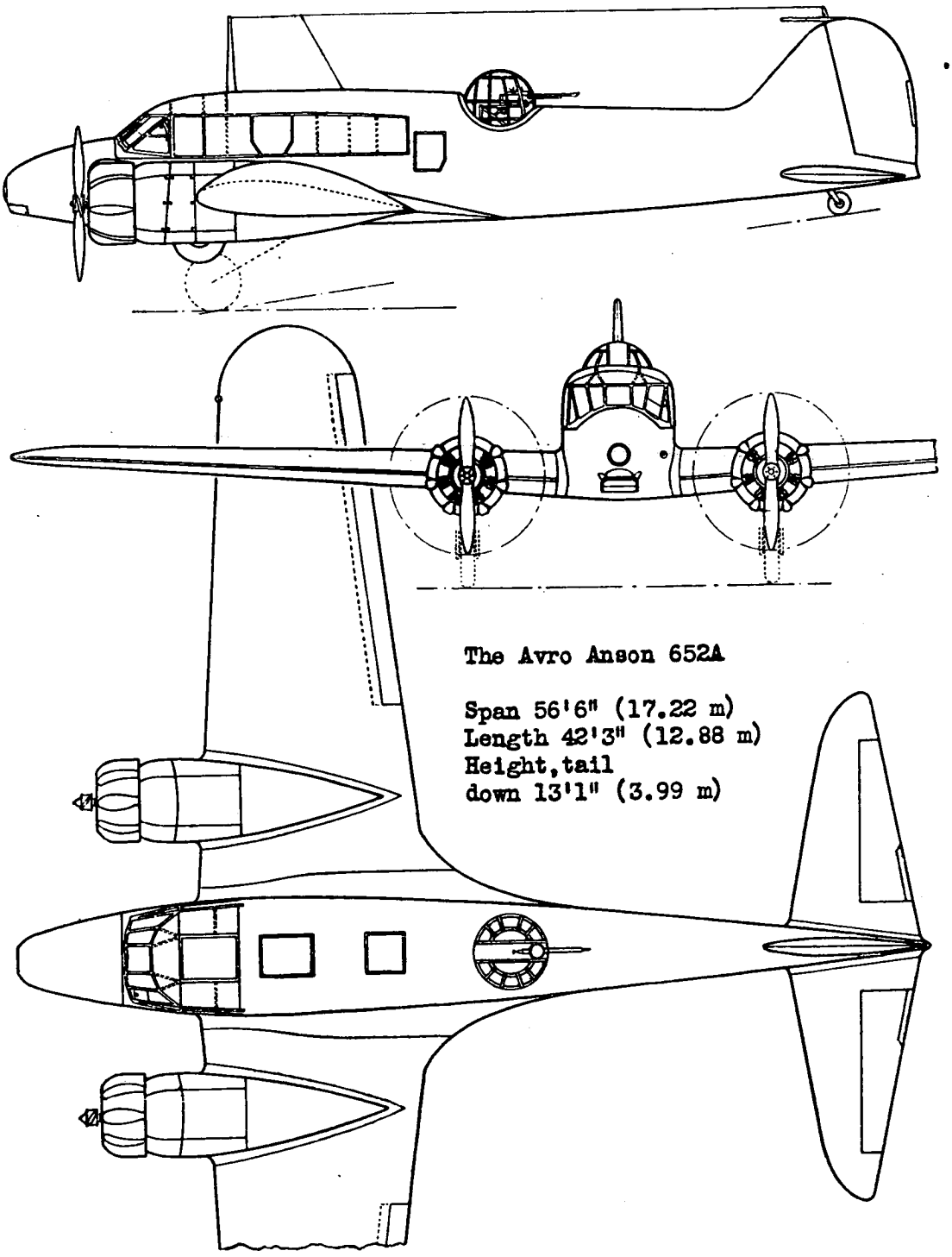

Figure 1.- General arrangement drawing of Avro Anson airplane.

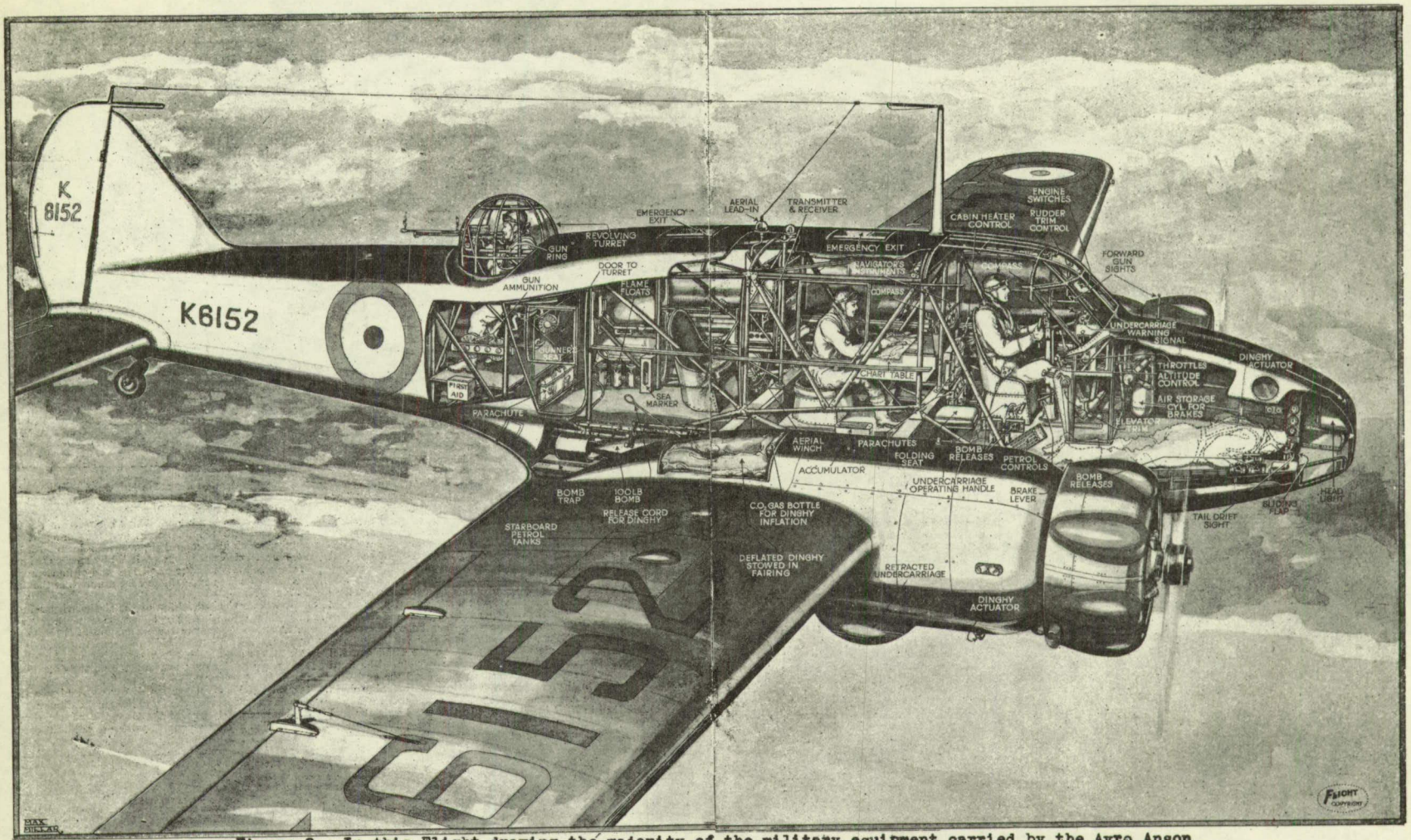

Figure 2.- In this Flight drawing the majority of the military equipment carried by the Avro Anson (two 310 hp. Siddeley Cheetahs) for over-water reconnaissance is visible. The figure shown dotted represents the navigator in his alternative position, where he acts as bomb-aimer. Note, in the nearest engine nacelle, the dinghy which is instantly inflated automatically should the airplane make a forced alighting on water. The complete bomb load is not shown: actually this consists of two 100 lb. bombs and four or eight twenty-pounders. The breech of the fixed Vickers gun is just visible to the left of the pilot.

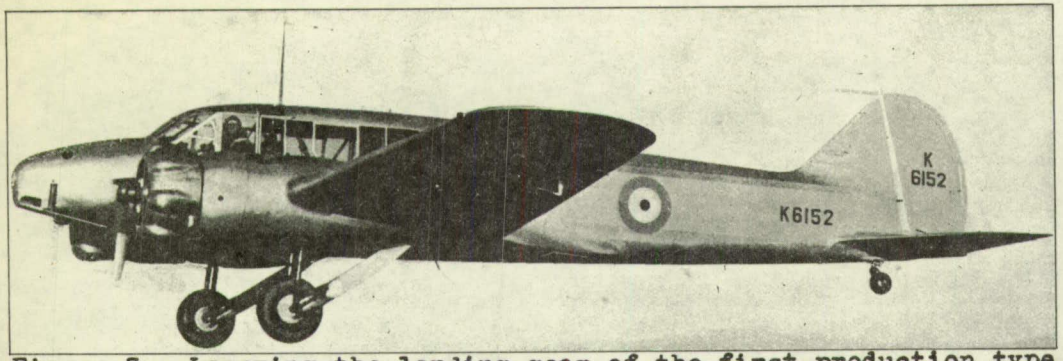

Figure 3.- Lowering the landing gear of the first production type Anson airplane.(Flight photograph)

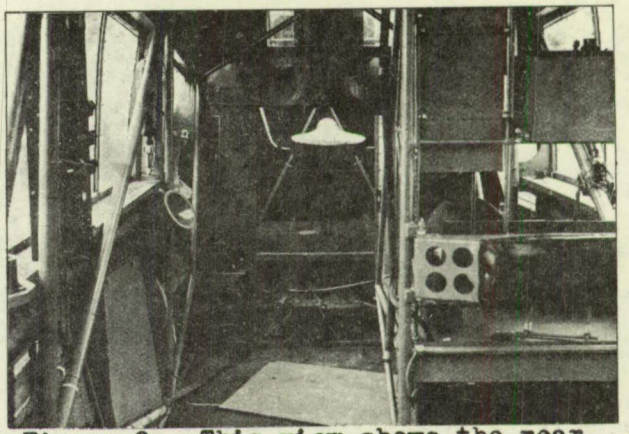

Figure 8.- This view shows the rear portion of the roomy cabin (without its complete equipment) and the door leading into the A.W. gun turret.(Flight photo)

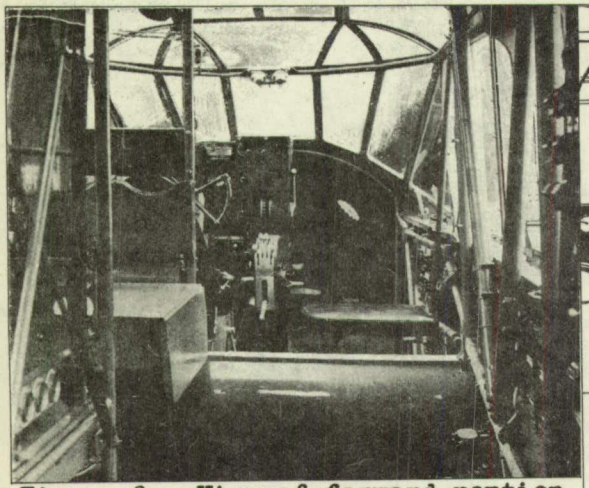

Figure 6.- View of forward portion of the cabin.(Flight photograph)

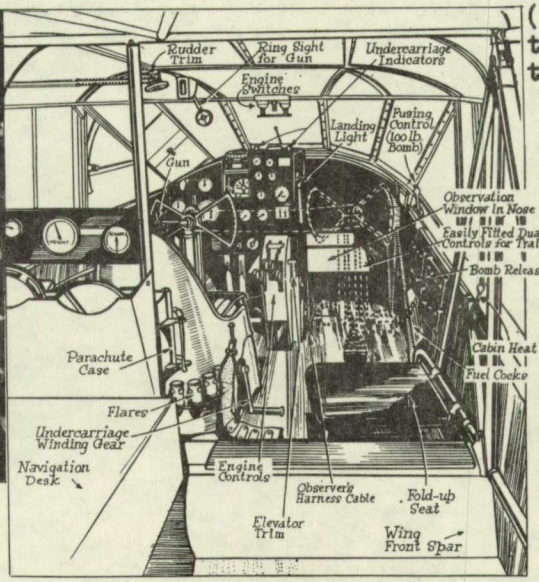

Figure 7.- Shows designations of equipment in forward portion of cabin.(The Aeroplane)

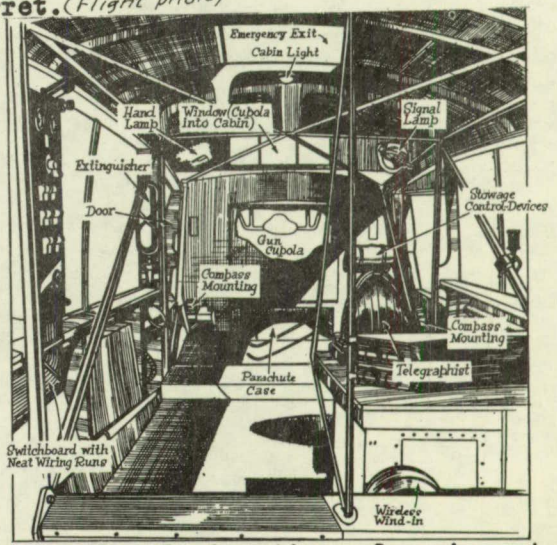

Figure 9.- Designation of equipment in rear portion of cabin. (The Aeroplane)

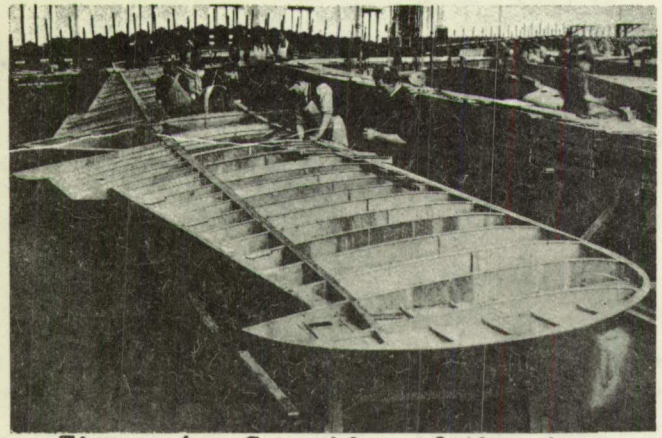

Figure 4.- Some idea of the size and the nature of the construction of the wing may be gathered from this view. "Flight"

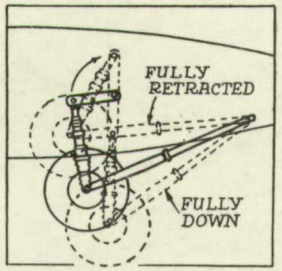

Figure 5.- Position of landing gear on the Anson.
"The Aeroplane Sketch"

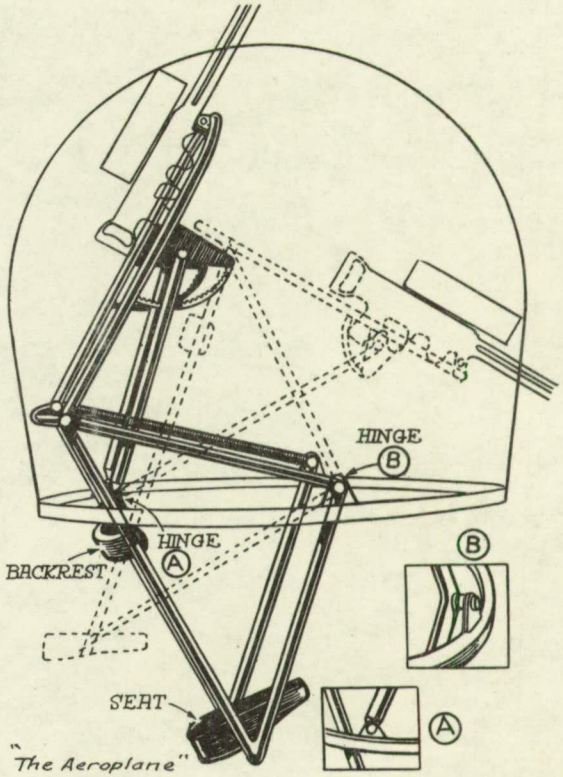

Figure 10.- The ingeniously simple mechanism of the Armstrong Whitworth rotatable gun-turret, as used in the Anson. The gunner sits on a saddle and maneuvers himself and gun by bending his legs.

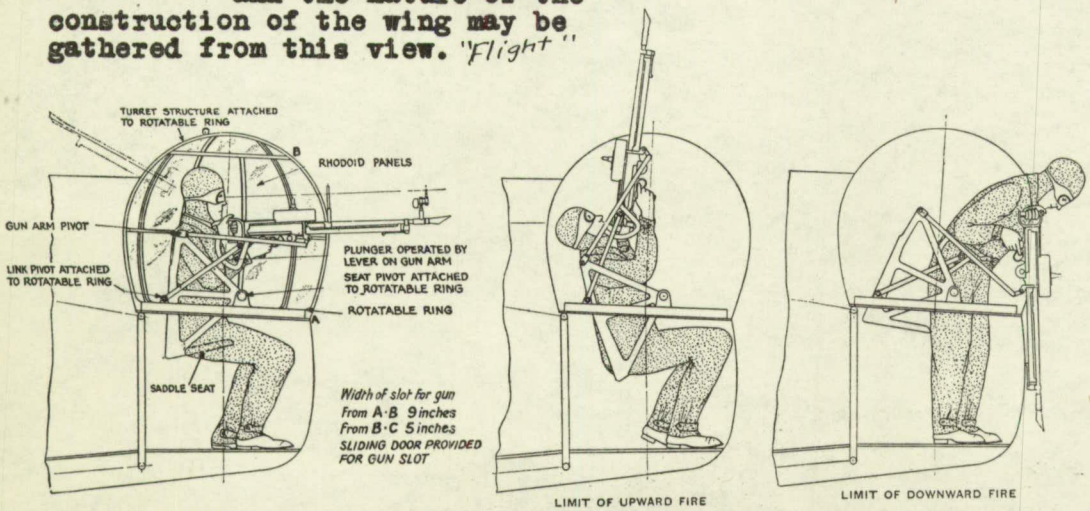

Figure 11.- These diagrams show the method of operation of the A.W. turret. The gunner stands to fire downwards. "Flight"